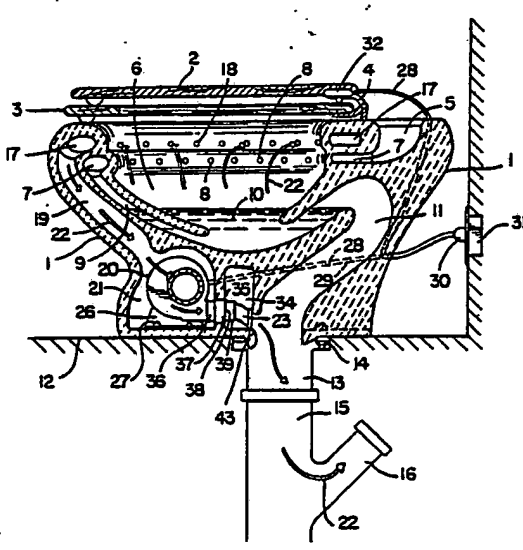




INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification⁴ : E03D 9/04	A1	(11) International Publication Number: WO 88/ 06661 (43) International Publication Date: 7 September 1988 (07.09.88)
(21) International Application Number: PCT/US88/00655 (22) International Filing Date: 3 March 1988 (03.03.88) (31) Priority Application Number: 021,240 (32) Priority Date: 3 March 1987 (03.03.87) (33) Priority Country: US (60) Parent Application or Grant (63) Related by Continuation US 021,240 (CIP) Filed on 3 March 1987 (03.03.87) (71)(72) Applicant and Inventor: RATANANGSU, Karl, S. [US/US]; 7752 Bellair Avenue, North Hollywood, CA 91605 (US).		(74) Agents: CLARK, Gary, A. et al.; Pretty, Schroeder, Brueggemann & Clark, 444 South Flower Street, Suite 2000, Los Angeles, CA 90071 (US). (81) Designated States: AT (European patent), AU, BE (European patent), CH (European patent), DE (European patent), FR (European patent), GB (European patent), IT (European patent), JP, KR, LU (European patent), NL (European patent), SE (European patent), US. Published <i>With international search report.</i> <i>Before the expiration of the time limit for amending the claims and to be republished in the event of the receipt of amendments.</i>
(54) Title: IMPROVED VENTILATING TOILET (57) Abstract A ventilating toilet for removing contaminated air from a toilet bowl (1) through a ventilating system which is entirely integral with the plumbing system of the toilet. A ventilation blower (20) is located with a compartment formed in the base portion of the toilet body, generally in front of and beneath the toilet bowl. Contaminated air is drawn through ventilation openings (18) in the toilet bowl rim to the ventilation blower (20) by way of a ventilation passageway (19) which is integrally formed within the front part of the toilet body, and the ventilation blower (20) exhausts the contaminated air through an opening into the waste passageway of the toilet for venting through the drain vent (16) of a conventional drain line (13). A damper (23) is provided at the exhaust output of the ventilation blower (20) to prevent back flow of sewer gases through the ventilation system and infiltration of fluids caused by drain line blockages or the like into the ventilation blower. The ventilation blower (20) is selectively energized as by raising and lowering of the toilet seat (3). 		

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IMPROVED VENTILATING TOILETCROSS-REFERENCE TO RELATED APPLICATION

This application is a continuation-in-part of my co-pending application for U.S. Letters Patent, Serial No. 021,240, filed on March 3, 1987 entitled "Improved Ventilating Toilet".

BACKGROUND OF THE INVENTION

The present invention relates generally to ventilating toilets and, more particularly, to an improved ventilating toilet having an integral system for ventilating offensive odors.

A common means of ventilating a bathroom is by using vents and fans in the ceiling or wall to carry contaminated air from the room. This ventilating means presents numerous disadvantages. A large quantity of heated or air-conditioned air is removed which must be replaced. The fans are typically noisy. When and how long the venting fans will run is not automatically controlled. Installation and modification of the bathroom to install such ventilating means is difficult, can leave unattractive results and is relatively expensive.

Various types of ventilation systems have been proposed to retrofit or otherwise incorporate in toilets themselves. Examples of these systems are disclosed in the following U.S. patents:

	<u>Patent No.</u>	<u>Inventor</u>	<u>Issued</u>
5	1,911,032	Minkler	5/33
	2,119,529	Dick	6/38
	2,124,017	Vandiver	7/38
	2,240,094	Foreman	4/41
10	2,603,797	Baither	7/52
	2,728,088	Gudish	12/55
	3,064,274	Gleason	11/62
	3,120,006	Knappe	2/64
	3,501,784	Maisch	3/70
15	3,649,972	Sowards	3/72
	3,740,772	Paley	6/73
	3,790,970	Bendersky, et al.	2/74
	3,805,304	Ikehata	4/74
	3,999,225	Ables	12/76
20	4,365,361	Sanstrom	12/82

Most of the systems draw out air from the bowl through openings in the edge of the toilet bowl rim or a hollow seat by means of a ventilating motor. The motor may be located inside the toilet tank, externally near the toilet, or within an adjacent wall.

Problems can exist with these ventilation systems. These systems may require heavy motors and can be difficult to manufacture and to install. Considerable installation work may be needed to mount a ventilating motor within an adjacent wall or toilet water tank, requiring a large number of tubes, valves and fittings. Such systems can be bulky and complex, using a plurality of parts. Systems of the type using

motors located externally near the toilet can be unsightly. The contaminated air can be vented by these systems to another location in the bathroom, within an adjacent wall, or to the drain line through a series of pipes, the latter requiring modification of the plumbing system or the toilet bowl installation, or both.

A ventilating toilet overcoming at least some of these problems is shown and described in U.S. Patent No. 3,120,006, in which a blower assembly is positioned within the toilet body behind the toilet bowl, between the toilet seat and the tank. The blower is housed in a chamber which communicates between openings in the rim of the toilet bowl and the drain line by way of an air duct formed within the back side of the toilet. This prior ventilating toilet suffers from the disadvantages, however, that a person sitting on the toilet would at most be only inches from the chamber containing the blower motor, with its attendant noise and vibration. Also, the space available in a conventional toilet for housing a blower at the top of the toilet bowl between the toilet seat and the tank is very limited. As a result, the toilet body either must be enlarged to accommodate a larger blower motor, making the toilet less desirable, especially where space is at a premium, or else a smaller, noisier, less efficient and usually more expensive motor must be utilized. A further disadvantage is that the water intake to the toilet from a tank or other source is typically located at the top rear of the toilet bowl, and so to

also accommodate a blower assembly in this part of the toilet may necessitate restricting the water intake, thereby reducing the flushing efficiency of the toilet.

5 Thus, there exists a need for an improved ventilating toilet that overcomes these disadvantages. The present invention satisfies this need and provides further related advantages.

SUMMARY OF THE INVENTION

10 Briefly, and in general terms, the present invention provides a novel ventilating toilet with an integrally-housed ventilation blower means for removing contaminated air from the toilet bowl and expelling the contaminated air through a standard
15 drain line, in which the ventilation blower means is advantageously located within the toilet body so as to minimize unwanted noise and vibration, to avoid interference with the water intake, and to permit use of an adequately large capacity blower motor to ensure
20 proper ventilation without enlarging the overall size of the toilet body as compared to conventional non-ventilating toilets.

 Basically, the ventilating toilet of the present invention includes a toilet body having a
25 toilet bowl portion with an integral toilet bowl rim formed with one or more ventilation openings. Contaminated air is removed from the toilet bowl through the use of a ventilation blower disposed

within a blower compartment formed entirely within the front portion of a housing base portion of the toilet body, generally beneath the toilet bowl portion. The contaminated air is drawn through the ventilation openings in the toilet bowl rim to the ventilation blower by way of a ventilation passageway which also is integrally formed within the front part of the toilet body, away from the water intake to the toilet. An opening between the blower compartment and the main waste passageway of the toilet body allows the ventilation blower to blow contaminated air drawn from the toilet bowl into the waste passageway for venting through the drain vent of a conventional drain line to which the toilet is adapted to be connected. The ventilation blower is designed to be selectively energized as by raising and lowering of the toilet seat.

With the present invention, the ventilating system is entirely integral with the plumbing system of the toilet in that the toilet's own main waste passageway is used, in effect, as an exhaust vent so that the toilet appears substantially the same as a standard toilet. Moreover, locating the exhaust blower means within a compartment formed in the base portion of the toilet body utilizes what would otherwise be substantially wasted space in a conventional toilet design. Such positioning of the blower means allows for a generally large, efficient blower with a substantial cubic-feet-per-minute capacity to be utilized, resulting in rapid ventilation of contaminated air from the bowl.

Further, noise and vibration of the exhaust blower means are dampened substantially by locating the blower means low within the base portion of the toilet body. The invention is easy to install, convenient to use, relatively inexpensive to manufacture and aesthetically pleasing as one integral unit.

In a further aspect of the invention, the ventilating toilet incorporates a novel damper means at the exhaust output of the ventilation blower to not only prevent sewer gases in the drain line from infiltrating the room by back flow through the ventilating passageways in the toilet, but also to prevent unwanted fluids, resulting, for example, from a drain line blockage, from possibly causing damage to the ventilation blower or an electrical short.

Other features and advantages of the present invention will become apparent from the following more detailed description, taken in conjunction with the accompanying drawings, which illustrate, by way of example, the principles of the invention.

DESCRIPTION OF THE DRAWINGS

FIG. 1 is a cross-sectional view showing a presently preferred embodiment of a ventilating toilet embodying the principles of the invention;

FIG. 2 is a generally schematic front view of the ventilating toilet of FIG. 1, illustrating the location and spatial relationship of the ventilation

blower means and the input passageway from the toilet bowl rim to the ventilation blower means; and

FIG. 3 is an enlarged exploded view of the details of the damper means and its interconnection with the ventilation blower as embodied in the ventilating toilet of FIG. 1.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring now to the drawings, and particularly to FIG. 1 thereof, there is shown by way of example a presently preferred embodiment of a ventilating toilet incorporating the novel features of the present invention. The ventilating toilet includes a toilet body 1 having an oval toilet bowl portion and an integrally-formed housing base portion serving as a base for the toilet bowl portion. A conventional toilet lid 2 and a toilet seat 3 are mounted by a hinged connection 4 to the top of the toilet body 1 at the rear of the toilet bowl portion. The toilet body also conventionally includes a water intake opening 5, located at the top rear portion of the toilet body 1, which communicates with the interior 6 of the toilet bowl via a water passageway 7 through water openings 8 formed in the rim of the toilet bowl portion and a water hole 9 to discharge water for purposes of flushing solid and liquid waste from a water reservoir 10 into a waste passageway 11. Any suitable source of water, such as a conventional toilet tank (not shown), may be connected to the water intake opening 5 to provide the water necessary for

flushing. The toilet base portion of the toilet body 1 is shown resting on a floor 12 and connected to a conventional drain line 13 by mounting bolts 14. The drain line 13 is connected to a split connector 15, which includes a drain vent 16 that leads to the open atmosphere to vent odors and gases in the drain system.

Gaseous odors are emitted from the human body generally at or near body temperature and at greater than atmospheric pressure. These odors consequently will rapidly expand and spread throughout the interior of the toilet bowl and, unless controlled, will escape through the spaces between the toilet bowl rim and the toilet seat 3 and toilet lid 2. Control of such gaseous odors is accomplished in the preferred embodiment of the present invention by integrally forming a ventilation passageway 17 in the toilet body which communicates with the interior 6 of the toilet bowl via a set of ventilation openings 18 through the toilet bowl rim. The ventilation openings 18 are in the form of a plurality of spaced-apart holes. The ventilation passageway 17 leads via an integrally formed input passageway 19 to a ventilation blower 20 located in a blower compartment 21 formed in the housing base portion of the toilet body 1. The ventilation blower 20 is adapted to draw contaminated air 22 from the interior 6 of the toilet bowl and to discharge the contaminated air through a damper tube 23 (described in detail below in connection with FIG. 3) into the drain line 13.

The ventilation blower 20, which is of standard design including a blower motor 24 and a blower fan 25 (FIG. 3), resides on a base 26 that is secured to the floor of the blower compartment 21 by mounting screws 27. It is energized through a power cord comprising two electrical lines 28 and 29 leading to a standard electrical plug 30, which is shown plugged into an electrical supply outlet 31. In normal operation, the ventilation blower 20 is switched "on" and "off" automatically by the raising and lowering, respectively, of the toilet lid 2. This is accomplished by means of a normally closed or "on" push button switch 32 which is connected into one of the electrical power lines 28 and is appropriately mounted on the toilet lid 2 near its hinged connection 4 with the toilet seat 3 so that closing the toilet lid causes the button to be pushed to the "off" position. An opening 33 in one side wall of the housing base portion of the toilet body 1 (FIG. 2) provides access to the blower compartment. The opening 33 is adapted to receive a removable closure (not shown).

To obtain the best results with the present invention, it is important that the ventilation blower 20 is sufficiently powerful with a substantial cubic-feet-per-minute ("CFM") capacity. An important advantage of the present invention in this regard is that the blower compartment 21 is formed at the front of the housing base portion of the toilet body 1, generally underneath the toilet bowl portion. Persons

of skill in this field will appreciate that this space is otherwise unused in a conventional toilet design. It provides a large enough space to accommodate a standard commercially-available ventilation blower of upwards of 70 CFM, which provides adequate capacity. Utilizing this space avoids the added cost and noise associated with a specially-designed smaller blower that would be necessitated if the ventilation blower was attempted to be located elsewhere in the toilet body without substantially enlarging the size of the toilet. Locating the ventilation blower within the housing base portion beneath the toilet bowl is a significant advantage of the present invention in that it allows the toilet to retain the same overall size and appearance as a conventional toilet. A further advantage of this location is that it is relatively far removed from the toilet seat, and so excess noise and vibrations which may be disturbing to persons using the toilet are greatly dampened.

It can also be seen in FIG. 1 that the ventilation passageway 17 and the input passageway 19 for the passage of contaminated air from the toilet bowl to the ventilation blower 20 are disposed within the toilet body so as not to restrict or otherwise interfere with the water intake 5 and water passageway 7. In any toilet it is important to maintain maximum water siphoning and suction during the flushing action. If the ventilation blower 20 were located elsewhere in the toilet body, such interference or restriction of the water intake and passageway could be necessary and would diminish the

flushing efficiency of the toilet. In the preferred embodiment of the invention, the input passageway 19 is located at the front of the toilet body 1, as far from the water intake 5 as possible.

5 As shown in FIG. 2, the input passageway 19 extends vertically along the center-line of the toilet bowl in the preferred embodiment and joins the diverging segments of the ventilation passageway 17 that extend in both directions along the toilet bowl
10 rim. The combined cross-sectional areas of these diverging segments of the ventilation passageway 17, as well as those of the ventilation openings 18, are substantially the same as the cross-sectional area of the input passageway 19. The cross-sectional area of
15 the input passageway, in turn, is substantially the same as the cross-sectional area of the output passageway from the ventilation blower 20. By making each of these passageways at least as large as the blower output opening, maximum CFM output from the
20 ventilation blower 20 is obtained.

Referring now to FIGS. 1 and 3 together, the detailed construction of the damper system which is connected to the output of the ventilation blower 20 will be described. It is one of the purposes of the
25 damper system to prevent sewer gases from escaping into the room where the toilet sits by natural back flow upwardly through the ventilation passageways in the toilet. Another purpose of the damper system is to prevent unwanted fluids, which may result, for
30 example, from blockages in the drain line, from

reaching the ventilation blower 20, where such fluids could cause damage to the blower and risk of electrical shorts.

The primary component of the damper system is the damper tube 23, which is disposed within a damper chamber 34 formed in the housing base portion of the toilet body 1 between the blower compartment 21 and the waste passageway 11. The damper chamber 34 and the blower compartment 21 are separated by a wall 35 having an enlarged round opening therethrough spaced above the floor of the damper chamber. On its opposite side, the damper chamber 34 has a similarly-sized opening through to the waste passageway 11 which is located at floor level, i.e., below the level of the opening between the damper chamber and the blower compartment 21.

The housing of the ventilation blower 20 surrounding the blower fan 25 is fitted at its exhaust output with an adapter 36 having a passageway formed therethrough which is provided with internal threads. A generally cylindrical output connector 37 serves to join the damper tube 23 to the blower adapter 36. To this end, the output connector 37 is provided with external threads to threadedly mate with the adapter 36 through the opening in the damper chamber wall 35. An annular flange or collar 38 that is formed around the output connector 37 serves to sealingly engage the damper chamber wall 35. Affixed to the opposite side of the annular flange 38, as by adhesive, is a length of spring tube 39. The open end

of the spring tube 39 is covered by a screen plate 40, and the damper tube 23 is received over the end of the spring tube.

5 For clarity of viewing, only a cross-section and the end of the damper tube are illustrated by solid lines in FIG. 3, while the outline of the damper tube is generally indicated only by phantom lines. To enable the damper tube 23 to perform the function of either a water damper or an air damper as conditions dictate, the damper tube is formed with a relatively thick layer of elastic material on its lower half 41 and a relatively thin layer of elastic material on its upper half 42. Any suitably durable elastomer having the property of floating in water may be chosen as the material. Further, there is a float ring 43, suitably held at the free end of the damper tube 23, which may be formed by simply rolling over and fixing the end of the damper tube.

20 In normal operation, when there is no water or sewage backed up in the drain line 13, the float ring 43 provides weight sufficient to drop the free end of the damper tube 23 to the bottom of the damper chamber 34. It will be appreciated that, in this position, the damper tube 23 has a downward slope tending to prevent passing water, as during flushing of the toilet, from entering the tube. The force of the air blown by the ventilating blower 20 (when in operation) is sufficient to lift the thin upper half 42 of the damper tube 23, thereby generally aligning the float ring 43 with the opening in the

30

damper chamber 34 through to the waste passageway 11, to permit exhaustion of air to the drain line 13 as shown in FIG. 1. When the ventilating blower 20 is not operating, the damper tube 23 collapses to prevent
5 back flow of sewer gases into the ventilation passages of the toilet.

Under conditions where fluid may back up in the drain line 13, the free end of the damper tube 23 including its float ring 43 will begin to float as the
10 fluid level reaches the exhaust opening in the damper chamber. This prevents entry of unwanted fluids into the damper tube 23 that could otherwise reach the blower compartment 21, possibly damaging the ventilation blower 20 and creating risk of an
15 electrical short in the blower motor 24. As the fluid continues to rise, it exerts ever increasing pressure against the thick lower half 41 of the damper tube 23, tending to press it against the screen plate 40. This operates to create a seal against entry of fluid into
20 the damper tube. The relative thickness of the lower half 41 of the damper tube 23 helps ensure that it will press flat against the screen plate 40 without wrinkling. The higher that the fluid level reaches, of course, the greater becomes the pressure against
25 the lower half 41 of the damper tube 23 and, hence, the better is the seal that is formed to ensure that no fluid reaches the ventilation blower 20.

To further ensure against the undesirable consequences of fluid reaching the ventilation
30 blower 20, the ventilating toilet includes means for

disabling the electrical power connection to the blower motor 24 as fluid fills the damper chamber 34. In this regard, a breaker switch 44 with a spring-loaded arm 45 is mounted adjacent to the ventilation blower 20 within the blower compartment 20. The breaker switch 44 is electrically connected in series in the power line 28 leading to the blower motor 24. This electrical connection can be formed within a water tight seal. A cord 46 extends from the arm 45 through a hole 47 in the housing of the ventilation blower 20 and then along the inside of the output connector 37 and through the spring tube 39 for connection to the screen plate 40. The cord 46 is installed in taut condition such that in normal operation of the ventilating system of the toilet the cord pulls the arm 45 to maintain breaker switch 44 in a normally closed or "on" state.

When fluid backs up into the damper chamber 34, the spring tube 39 is designed to compress in response to the pressure applied by the lower half 41 of the damper tube 23 against the screen plate 40. The compression of the spring tube 39 causes it to shorten and hence reduce the tautness of the cord 46. As the cord 46 relaxes, the spring-loaded arm 45 of the breaker switch 44 is permitted to move to an open or "off" position, disconnecting electrical power from the blower motor 24. It will be appreciated that the blower motor 24 is thus disabled regardless of whether the toilet lid is raised. When the fluid recedes from the damper chamber 34, the damper tube 23 will relax and

fall, permitting the spring tube 40 to extend and pulling the cord 46 taut again. The breaker switch 44 will thus be returned to its normally closed condition.

5 Optionally, the opening of breaker switch 44 could also be utilized to trigger an appropriate aural or visual alarm (not shown) to signal that the ventilation system of the toilet has been
10 automatically disabled by probable reason of a clogged drain line. The user would then be warned to take appropriate steps, including possibly disconnecting the electrical plug 30 from the electrical supply outlet 31.

15 The new and improved ventilating toilet of the present invention satisfies a long existing need for a relatively simple, safe, economical and effective ventilating system in a toilet which is easy to install without modification to the existing plumbing or surrounding structure and which does not
20 require any added space compared to conventional toilet designs.

25 It will be apparent from the foregoing that, while a particular form of the invention has been shown and described, various modifications can be made without departing from the spirit and scope of the invention. Accordingly, it is not intended that the invention be limited, except as by the appended claims.

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I claim:

1. A ventilating toilet comprising:

a toilet body having a toilet bowl portion and a housing base portion serving as a base for said toilet bowl portion, said toilet bowl portion including a generally oval opening and a toilet bowl rim integrally formed around the periphery of said opening, and said toilet base portion adapted for connection to a drain line provided with a split connector having a drain vent to permit the ventilation of contaminated air from the drain line;

a waste passageway formed within said housing base portion, said waste passageway serving for the passage of waste from said toilet bowl portion to a drain line;

means, defining one or more ventilation openings through a surface of said toilet bowl rim, for receiving odors from said toilet bowl;

a hollow compartment formed within said housing base portion of said toilet body, said compartment disposed frontally within said housing base portion generally underneath said toilet bowl portion, and said compartment including an opening for communication with said waste passageway;

a ventilation passageway integrally formed within said toilet body, said ventilation passageway

extending from said ventilation openings in said toilet bowl rim to said hollow compartment to allow the flow of contaminated air received through said ventilation openings to said hollow compartment;

ventilation blower means, disposed within said hollow compartment in said housing base portion, for selectively drawing contaminated air through said ventilation openings in said toilet bowl rim and into said compartment by way of said ventilation passageway, said ventilation blower means serving to blow such contaminated air out said opening in said compartment into said waste passageway for ventilation through the drain vent of the drain line; and

means for selectively energizing said exhaust blower means.

2. A ventilating toilet as set forth in claim 1, wherein said ventilation passageway is disposed in the frontal portion of said toilet body.

3. A ventilating toilet as set forth in claim 1, wherein said means for defining one or more ventilation openings comprise a plurality of spaced-apart holes formed in an interior surface of said toilet bowl rim.

4. A ventilating toilet as set forth in claim 1, and further including:

a toilet lid connected to said toilet body by hinge means for raising and lowering said toilet lid; and
5

wherein said means for selectively energizing said ventilation blower means is effective to energize said ventilation blower means as a function of the raising of said toilet lid and to deenergize said
10 ventilation blower means as a function of the lowering of said toilet lid.

5. A ventilating toilet as set forth in claim 1, and further including:

means for preventing odors from the drain line escaping to said toilet bowl through said
5 ventilation passageway, said means permitting the blowing of contaminated air by said ventilation blower means into said waste passageway.

6. A ventilating toilet as set forth in claim 5, wherein said means for preventing odors from the drain line escaping to said toilet bowl comprise a damper disposed within said opening between said
5 ventilation blower means and said waste passageway, said damper normally closed when said ventilation blower means is not energized, and said damper opening in response to energization of said ventilation blower means to permit the blowing of contaminated air by
10 said ventilation blower means into said waste passageway.

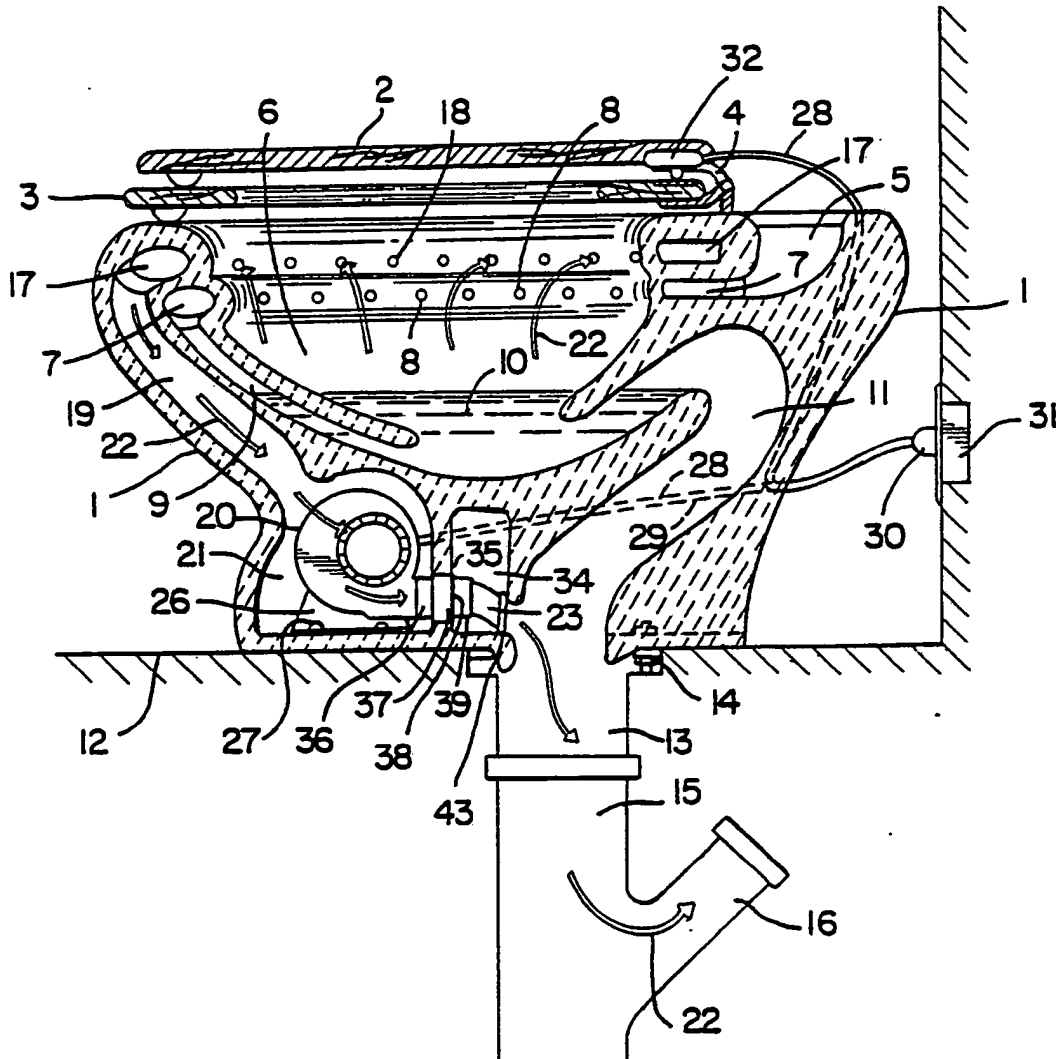
7. A ventilating toilet as set forth in claim 6, wherein said damper comprises a flexible open-ended tube having one end sealingly connected to said ventilation blower to receive the contaminated air and an opposite free end disposed to exhaust the contaminated air into said ventilation passageway.

8. A ventilating toilet as set forth in claim 7, wherein said damper tube includes a ring at its free end, said ring permitting said damper tube to be lifted by the force of the air blown by said ventilation blower means and allowing the exhaustion of the air into said waste passageway, and said ring causing said damper tube to collapse when said ventilation blower means is not operating, thereby preventing the back flow of air into said damper tube.

9. A ventilating toilet as set forth in claim 8, wherein said damper tube including said ring are adapted to float in water to prevent fluids which back up in said waste passageway from entering said damper tube; and wherein said damper tube has a lower half which is pressed against and creates a seal at the output of said ventilation blower means upon increasing pressure from the back up of fluids in said waste passageway, thereby preventing the fluids from reaching said ventilation blower means.

10. A ventilating toilet as set forth in claim 9, and further including:

means for de-energizing said ventilation blower means in response to fluids backing up in said waste passageway to said damper tube.

*FIG. 1.*

SUBSTITUTE SHEET

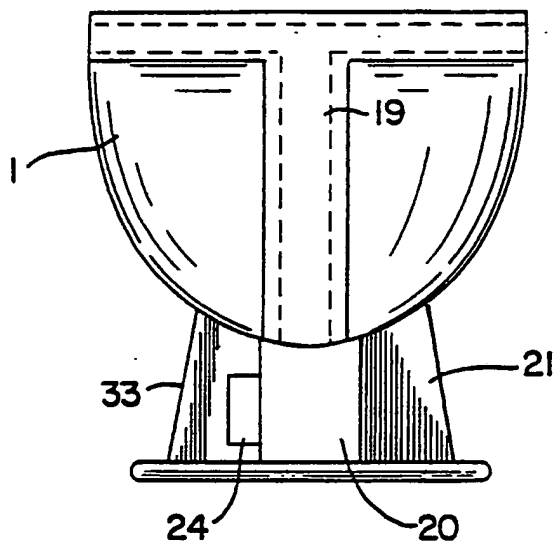


FIG. 2.

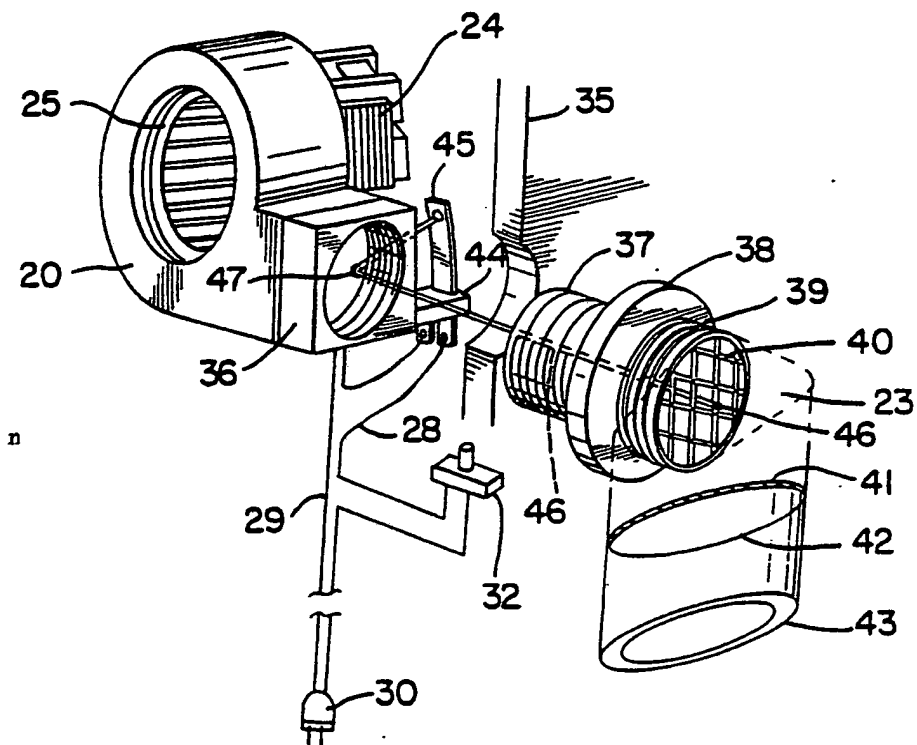


FIG. 3.

INTERNATIONAL SEARCH REPORT

International Application No. PCT/US88/00655

I. CLASSIFICATION OF SUBJECT MATTER (If several classification symbols apply, indicate all) ⁶ According to International Patent Classification (IPC) or to both National Classification and IPC <div style="text-align: center; font-size: 1.2em;">IPC (4): E03D 9/04</div>														
II. FIELDS SEARCHED <div style="text-align: center; font-size: 0.8em;">Minimum Documentation Searched ⁷</div> <table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 20%; padding: 5px;">Classification System</td> <td style="padding: 5px;">Classification Symbols</td> </tr> <tr> <td style="padding: 5px; text-align: center;">U.S.</td> <td style="padding: 5px; text-align: center;">4/213-219</td> </tr> </table> <div style="text-align: center; font-size: 0.8em;">Documentation Searched other than Minimum Documentation to the Extent that such Documents are Included in the Fields Searched ⁸</div>			Classification System	Classification Symbols	U.S.	4/213-219								
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U.S.	4/213-219													
III. DOCUMENTS CONSIDERED TO BE RELEVANT ⁹ <table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <th style="width: 10%; padding: 5px;">Category [*]</th> <th style="width: 70%; padding: 5px;">Citation of Document, ¹¹ with indication, where appropriate, of the relevant passages ¹²</th> <th style="width: 20%; padding: 5px;">Relevant to Claim No. ¹³</th> </tr> <tr> <td style="text-align: center; padding: 5px;">Y</td> <td style="padding: 5px;">USA 3,120,006 pub Feb. 1964 (Knappe) See entire document</td> <td style="text-align: center; padding: 5px;">1-5</td> </tr> <tr> <td style="text-align: center; padding: 5px;">Y</td> <td style="padding: 5px;">USA 1,972,774 pub Sept. 1934 (Hartwell) See entire document</td> <td style="text-align: center; padding: 5px;">1-7</td> </tr> <tr> <td style="text-align: center; padding: 5px;">A</td> <td style="padding: 5px;">USA 3,805,304 pub April 1974 (Ikehata)</td> <td></td> </tr> </table>			Category [*]	Citation of Document, ¹¹ with indication, where appropriate, of the relevant passages ¹²	Relevant to Claim No. ¹³	Y	USA 3,120,006 pub Feb. 1964 (Knappe) See entire document	1-5	Y	USA 1,972,774 pub Sept. 1934 (Hartwell) See entire document	1-7	A	USA 3,805,304 pub April 1974 (Ikehata)	
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Y	USA 1,972,774 pub Sept. 1934 (Hartwell) See entire document	1-7												
A	USA 3,805,304 pub April 1974 (Ikehata)													
<div style="display: flex; justify-content: space-between;"> <div style="width: 45%;"> <p>[*] Special categories of cited documents: ¹⁰</p> <p>"A" document defining the general state of the art which is not considered to be of particular relevance</p> <p>"E" earlier document but published on or after the international filing date</p> <p>"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)</p> <p>"O" document referring to an oral disclosure, use, exhibition or other means</p> <p>"P" document published prior to the international filing date but later than the priority date claimed</p> </div> <div style="width: 50%;"> <p>"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention</p> <p>"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step</p> <p>"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.</p> <p>"Δ" document member of the same patent family</p> </div> </div>														
IV. CERTIFICATION <table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 50%; padding: 5px;"> Date of the Actual Completion of the International Search <div style="text-align: center; font-size: 1.2em;">13 May 1988</div> </td> <td style="width: 50%; padding: 5px;"> Date of Mailing of this International Search Report <div style="text-align: center; font-size: 1.2em;">12 JUL 1988</div> </td> </tr> <tr> <td style="padding: 5px;"> International Searching Authority <div style="text-align: center; font-size: 1.2em;">ISA/US</div> </td> <td style="padding: 5px;"> Signature of Authorized Officer <div style="text-align: center;">Charles E. Phillips</div> </td> </tr> </table>			Date of the Actual Completion of the International Search <div style="text-align: center; font-size: 1.2em;">13 May 1988</div>	Date of Mailing of this International Search Report <div style="text-align: center; font-size: 1.2em;">12 JUL 1988</div>	International Searching Authority <div style="text-align: center; font-size: 1.2em;">ISA/US</div>	Signature of Authorized Officer <div style="text-align: center;">Charles E. Phillips</div>								
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FURTHER INFORMATION CONTINUED FROM THE SECOND SHEET

V. ☒ OBSERVATIONS WHERE CERTAIN CLAIMS WERE FOUND UNSEARCHABLE ¹

This International search report has not been established in respect of certain claims under Article 17(2) (a) for the following reasons:

1. ☐ Claim numbers _____, because they relate to subject matter ¹² not required to be searched by this Authority, namely:

2. ☒ Claim numbers 8-10, because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out ¹³, specifically:

it cannot be determined from the specification and drawings how the damper is constructed and operates, particularly the cooperation of elements 42, 43 and 32.

3. ☐ Claim numbers _____, because they are dependent claims not drafted in accordance with the second and third sentences of PCT Rule 6.4(a).

VI. ☐ OBSERVATIONS WHERE UNITY OF INVENTION IS LACKING ¹

This International Searching Authority found multiple inventions in this international application as follows:

1. ☐ As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims of the international application.

2. ☐ As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims of the international application for which fees were paid, specifically claims:

3. ☐ No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claim numbers:

4. ☐ As all searchable claims could be searched without effort justifying an additional fee, the International Searching Authority did not invite payment of any additional fee.

Remark on Protest

☐ The additional search fees were accompanied by applicant's protest.

☐ No protest accompanied the payment of additional search fees.